Oct-10-27

BE/ETRX/Sem VII/Rev

Filter Design

27-2-10

**Con. 5861–10.** **(REVISED COURSE)** **GT–8823**

( 3 Hours ) **[ Total Marks : 100**

**N.B. :** (1) Question **No. 1** is **compulsory**.
(2) Attempt any **four** questions out of the remaining **six** questions.
(3) Draw **suitable** diagrams and graphs wherever **necessary**.
(4) **Figures** to the **right** indicate **full** marks.

1. (a) Explain the difference between Butterworth, Chebyshev and Elliptical filters. Mention their merits and demerits. Derive expression for the order of Butterworth filter. **10**
   (b) What is Frequency Warping ? When do we use Bilinear transformation technique ? What is an antialiasing filter ? Why it is used ? **10**

2. (a) Explain the working principle of a switched capacitor filter. What are the necessary conditions for the implementation of a switched capacitor filter. What type of switches are used and what are its advantages ? Explain its implementation in a typical op-amp based integrator. **10**
   (b) Using bilinear transformation design a Digital Bandpass Chebyshev filter with the following specification $\alpha_p$ = 2 dB in the passband, (950 Hz) ≤ f ≤ (1150 Hz) $\alpha_s$ = 20 dB in the stopband, 0 ≤ f ≤ (550 Hz) and (2150 Hz) ≤ f ≤ ∞ sampling frequency f = 8 KHz. **10**

3. (a) Write difference between IIR and FIR filter. Explain frequency sampling method using suitable example. **10**
   (b) Convert the following pole-zero IIR filter into a lattice-ladder structure :– **10**

$$y(n) = -0{\cdot}9\, y(n-1) + 0{\cdot}8\, y(n-2) - 0{\cdot}5\, y(n-3) + x(n) + 2x(n-1) + 3x(n-2) + 2x(n-3)$$

4. (a) Explain a Linear phase FIR filter for the case of constant phase delay and group delay, using suitable equations. Draw Impulse response sequences of symmetric sequences for (i) N odd and (ii) N even. **10**
   (b) A low pass digital filter has following specifications :– **10**

$$0{\cdot}8 \le |H(e^{jw})| \le 1 \quad \text{for } 0 \le w \le 0{\cdot}2\,\pi$$
$$|H(e^{jw})| \le 0{\cdot}2 \quad \text{for } 0{\cdot}6\,\pi \le w \le \pi$$

Determine the order of Chebyshev and Butterworth filter to meet the following specification.

5. (a) What is an adaptive filter ? What are its advantages ? Which type of problem can be solved using adaptive filter. **10**
   (b) Convert a second order Butterworth filter (Low Pass) to Digital filter using impulse invariant techniques. **10**

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6. (a) Design a Butterworth bandstop filter with 2 dB passband edges of 30 Hz and 100 Hz and 40 dB stopband edges of 50 Hz and 70 Hz. **10**

(b) Explain Basic Wiener filter. **10**

**OR**

Explain the method of matched Z–transform.

7. (a) Explain Decimation and Interpolation. When it is required ? Take suitable examples. **10**

(b) Explain subband coding (**Or**) Quadrature mirror filtering. **10**

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